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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

Mr. William F. Caton
Secretary
Federal Communications Commission
1919 M Street, N.W.
Room 222
Washington, D.C. 20554

DOCKET FILE COPY ORIGINAL

Re: GN Docket No. 96-228, Wireless Communications Service

Dear Mr. Caton:

On January 6, 7 and 8, representatives of Primosphere Limited Partnership ("Primosphere"), met with Commission staff to discuss the need to revise the out-of-band emission limits on the Wireless Communications Service ("WCS") in order to protect satellite digital audio radio service ("satellite DARS") operations in the 2320-2345 MHz band.

During the meetings Primosphere emphasized that WCS out-of-band emissions into satellite DARS receivers at the levels proposed by the Commission would severely impair reception of satellite DARS. Primosphere provided copies of its technical analysis, submitted with its Comments and Reply Comments in the above-referenced proceeding, which demonstrate the need for more stringent out-of-band emission limits on WCS. Primosphere pointed out the unique circumstance of a satellite receive band sandwiched between two bands proposed for terrestrial service, including possible mobile service, which requires interference rules taking this into account.

Among the various technically and operationally feasible means by which WCS licensees could achieve the necessary limits include: spectrum planning (such as limiting the 5 MHz adjacent to the satellite DARS band to use by WCS mobile receivers, if a mobile service is implemented), pre-transmission pulse shaping, transmitter filtering, and cross-polarization between WCS transmitters and satellite DARS receivers.

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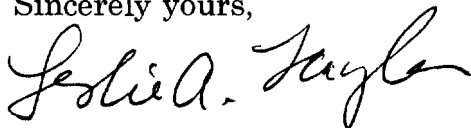
Leslie Taylor Associates - page 2

Since satellite DARS transmissions will operate at very low levels (significantly below PCS-like services), there can be no effective marketplace solution for resolving this potential interference situation. Thus, the Commission must adopt appropriate emission limits on WCS in order to ensure the usefulness to the American public of both satellite DARS and the WCS.

Attached are copies of the materials distributed at these meetings. Primosphere intends to submit additional technical material early next week.

If you have any questions, please contact the undersigned, or Robert Ungar, at (202) 775-4452.

Sincerely yours,



Leslie A. Taylor
Counsel
Primosphere Limited Partnership

Attachments

cc: Jonathan Cohen, Wireless Communications Bureau
D'wana Speight, Wireless Communications Bureau
Tom Stanley, Wireless Communications Bureau
Tom Mooring, Office of Engineering and Technology
Charles Iseman, Office of Engineering and Technology
Richard Smith, Office of Engineering and Technology
Bruce Franca, Office of Engineering and Technology
Michael Marcus, Office of Engineering and Technology
Ron Repasi, International Bureau
Tom Tycz, International Bureau
Don Gips, International Bureau
John Stern, International Bureau
Steve Sharkey, International Bureau
Rudolfo Baca, Office of Commissioner Quello
Jane Mago, Office of Commissioner Chong
David Siddall, Office of Commissioner Ness
Julius Genachowski, Office of the Chairman

David B. Jeppsen, Lucent Technologies, Suite 700, 900-19th St. NW

ISSUE

- WCS OUT-OF-BAND EMISSIONS STATED IN FCC NPRM (NOV 8, 1996) ARE NOT ADEQUATE TO PROTECT THE ADJACENT SDARS SERVICE.
- PROPOSED LIMIT ON WCS OUT-OF-BAND EMISSIONS INTO THE SDARS BAND WILL EXCEED SDARS RECEIVER NOISE OF 69 dB AT A CLEAR LINE-OF-SIGHT RANGE OF APPROXIMATELY 5 KM..
- NO RULES ON IN-BAND TRANSMISSION CHARACTERISTICS

SOLUTION

- REDUCE WCS GENERATED OUT-OF-BAND EMISSION LEVELS INTO THE SDARS BAND TO:

MOBILE	$123 + 10\text{LOG}(p)$ dB
FIXED	$92 + 10\text{LOG}(p)$ dB
- REQUIRE THAT WCS AND SDARS USE CIRCULAR POLARIZATION OF OPPOSITE SENSE.
- NO OTHER CHANGES ARE REQUIRED.

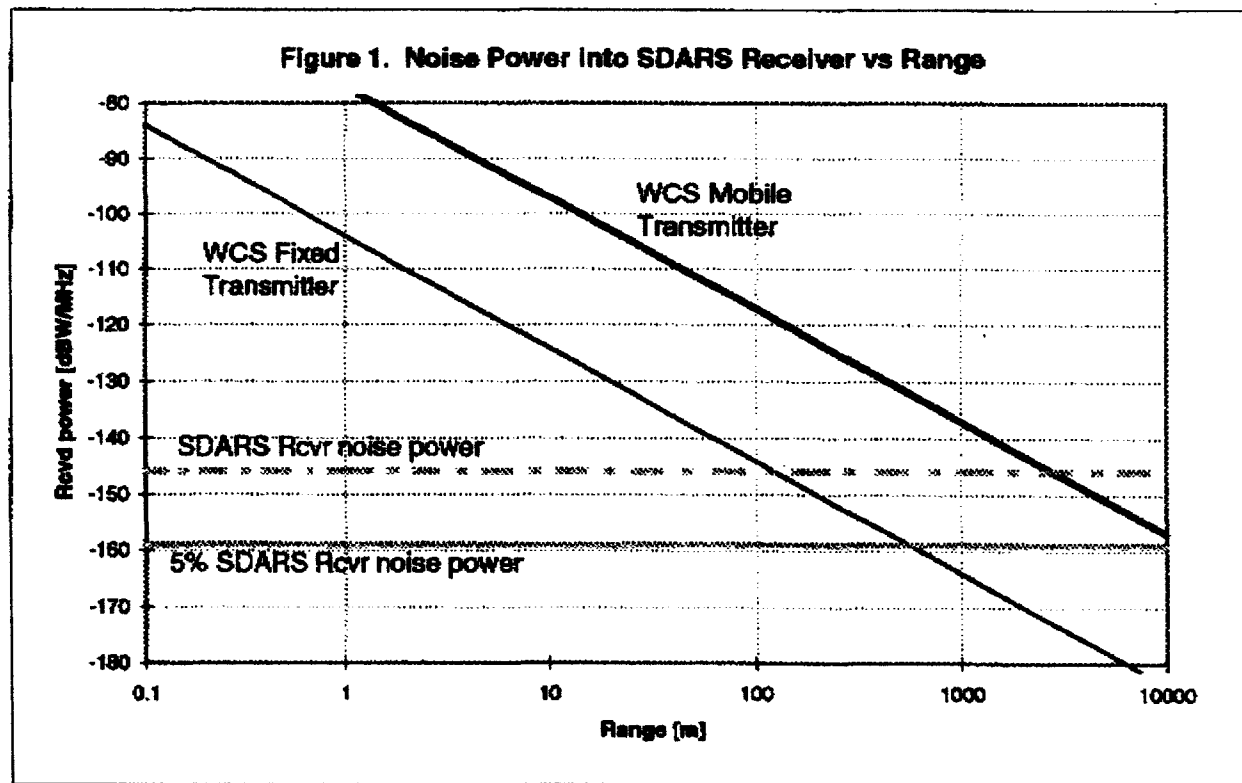
JUSTIFICATION OF WCS OUT-OF-BAND EMISSION PROTECTION

WCS INTERFERENCE INTO SDARS ANALYSIS

PARAMETER	FIXED	MOBILE	
SDARS Receiver Noise Temperature	200.0	200.0	(deg K)
Noise Energy	-145.6	-145.6	(dBW/MHz)
Allowable Increase in Noise Energy	0.2	0.2	(dB)
Interference Noise Energy	-158.6	-158.6	(dBW/MHz)
Distance to SDARS Receive Antenna	30.0	1.0	(m)
Frequency	2320.0	2320.0	(MHZ)
Free Space Path Loss	69.3	39.8	(dB)
SDARS Antenna Gain	3.0	3.0	(dB)
Proposed FCC Isolation	70.0	43.0	(dB)
WCS Interference to SDARS ✱	-136.3	-79.8	(dBW/MHz)
Additional Isolation Required	22.3	78.9	(dB)
Proposed Isolation Specification	92	122	(dB)

✱ referenced to 0dB

JUSTIFICATION OF WCS OUT-OF-BAND EMISSION PROTECTION



PRACTICALITY OF SOLUTION

- **EMPHASIS ON MINIMAL RULES THAT CAN BE IMPLEMENTED USING PROVEN TECHNOLOGY AND ARE ECONOMICALLY FEASIBLE.**
- **TOOLS AVAILABLE TO REDUCE WCS INTERFERENCE IN THE SDARS BAND:**

FREQUENCY PLANNING

TRANSMIT FILTERING

SIGNAL SHAPING

CROSS POLARIZATION

FILTERING AND SIGNAL PROCESSING

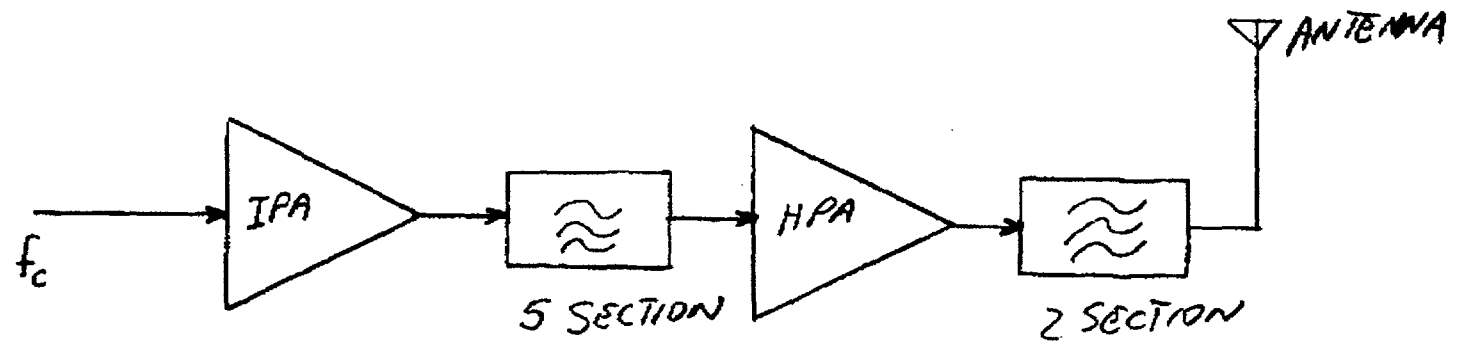
- **FILTERING DISTRIBUTED THROUGHOUT TRANSMITTER.**
- **MOST FILTERING TO BE DONE PRIOR TO FINAL POWER AMPLIFIER TO MINIMIZE IMPACT OF IN-BAND INSERTION LOSS.**
- **AMPLIFICATION AFTER FILTERING TO BE LINEAR AVOIDING SPECTRUM GROWTH.**
- **SIGNAL SHAPING PRIOR TO TRANSMITTER.**

CROSS-POLARIZATION

- **CIRCULAR POLARIZED ANTENNAS ARE TECHNICALLY WELL PROVEN AND WIDELY USED. NO ECONOMIC IMPACT**
- **POLARIZATION SHOULD BE CIRCULAR WITH WCS AND SDARS BANDS USING OPPOSITE SENSE.**
- **EXPECTED POLARIZATION ISOLATION 15 dB.**

TYPICAL SOLUTION

- FREQUENCY PLANNING + SIGNAL SHAPING + FILTERING + CIRCULAR POLARIZATION.
- CONFIGURATION



F_c = CENTER FREQUENCY

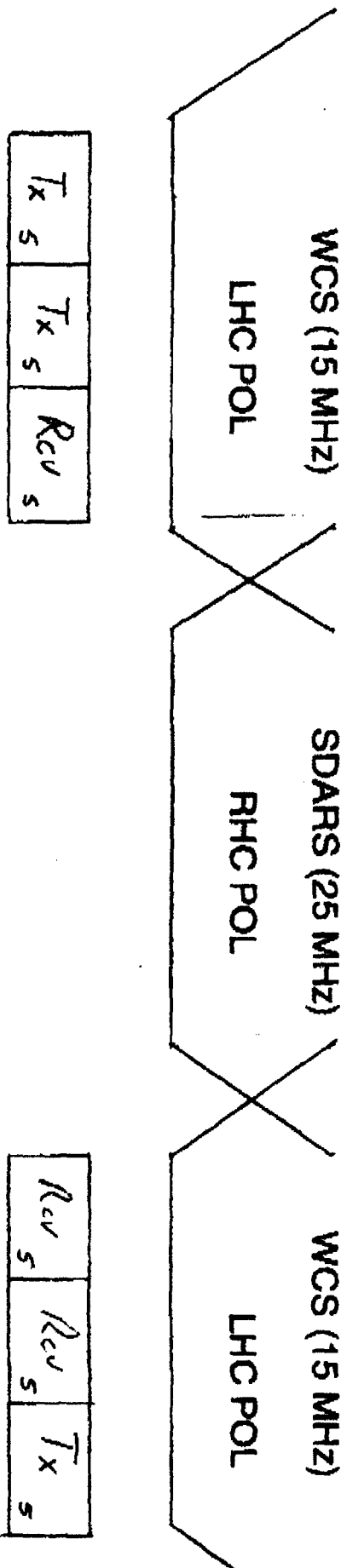
FOR EXAMPLE 7.5 MHZ AWAY FROM
EDGE OF SDARS $[(5 + 5/2)\text{MHZ}]$

REJECTION AT SDARS BAND EDGE

IPA SPECTRUM ROLL-OFF	30 dB
5 SECTION FILTER	63 dB
2 SECTION OUTPUT FILTER	15 dB
CROSS-POLARIZATION ISOLATION	15 dB
TOTAL	123 dB

PRIMOSPHERE

POSSIBLE FREQUENCY PLAN



ATTACHMENT B -TECHNICAL STATEMENT

In its WCS NPRM, the FCC proposes out-of-band emission criteria for fixed, mobile and satellite DARS services in the bands set aside for WCS. The proposed limits for out-of-band emissions spectral density from WCS operations into the spectrum set aside only for Satellite DARS, 2320 to 2345 MHZ, may not exceed the following:

$$\begin{array}{ll} 70 + 10\text{Log}(p) \text{ dB/MHZ} & \text{fixed services} \\ 43 + 10\text{Log}(p) \text{ dB/MHZ} & \text{mobile operations} \end{array}$$

Where p is the maximum spectral power density.

Our analysis shows that these proposed limits will result in unacceptable WCS out-of-band emissions into the band set aside for satellite DARS services, 2320 to 2345 MHZ. If adopted, these limits will seriously disrupt satellite DARS services planned for the band 2320 to 2345 MHZ. This Technical Statement analyzes the level of this disturbance and proposes alternative limits for out-of-band emissions spectral density from WCS operations into the band 2320 to 2345 MHZ.

INTERFERENCE ANALYSIS

The satellite DARS satellite-to-mobile link is characterized by sensitive satellite receivers connected to non-steered broad beam antennas. Our analysis considers three WCS transmission modes:

1. Fixed transmitter, directional antenna;
2. Fixed transmitter, hemispherical antenna; and
3. Mobile transmitter, hemispherical antenna.

This interference analysis is based on limiting interference from WCS to satellite DARS to no more than a 0.2 dB or 5% increase in satellite DARS system noise. The Primosphere mobile receivers operating will have system noise temperatures of approximately 200° kelvin and a 3 dB gain non-steered hemispherical antenna.

In cases 1 and 2 we assumed the WCS transmitter was on a tower 100' away from the satellite DARS receiver operating in a mobile vehicle. In case 3 we assumed that the WCS transmitter was hand held and 3' away either in the satellite DARS equipped mobile vehicle or adjacent to it. It is worth noting that although this places the WCS transmitter in the satellite DARS antenna near field we have used far field antenna gain. The calculation of near field antenna gain would greatly complicate these calculations and not significantly change the results. We believe this to be a reasonable worst case for "PCS like" mobile operations in the WCS bands.

Although the probability of a mobile vehicle with satellite DARS driving through the beam of a directional fixed WCS antenna is low, case 1 must be addressed. Satellite DARS must be protected since a satellite DARS equipped mobile may be stop or be parked in close to a fixed WCS service tower or a listener with a fixed satellite DARS receiver may be in a WCS a fixed service beam. Therefore we have combined our treatment of cases 1 and 2 into one analysis.

Attachment A

The results of our analysis for cases 1, 2 and 3 are contained in ~~Table 1~~. Cases 1 and 2 are combined in the column titled "Fixed." These results clearly show that interference for cases 1 (fixed transmitter, directional antenna, 2 (fixed transmitter, hemispherical antenna) and 3 (mobile) WCS operations, will greatly exceed acceptable limits for satellite DARS. In fact for case 3 WCS generated noise in the satellite DARS band would exceed the satellite DARS system noise level by an intolerable 80 dB. At this level of a single WCS mobile transmitter operating within 10 km of the satellite DARS receiver will increase noise in excess of 0.2 dB. Further, a single WCS mobile transmitter will fatally impair the operation of all satellite DARS receivers within a 5 km range.

REQUIRED SOLUTION

The proposed out-of-band emission criteria for fixed, mobile and satellite DARS services in the bands set aside for WCS as contained in the NPRM are inadequate to protect satellite DARS. These limits need to be modified to more effectively limit WCS generated interference in the band set aside for satellite DARS. It is recommended that the proposed limits be set as follows:

Out-of-band emissions spectral density from WCS operations into the spectrum set aside only for satellite DARS, 2320 to 2345 MHz, may not exceed:

$92 + 10\log(p)$ dB/MHz	fixed services, directional antenna
$92 + 10\log(p)$ dB/MHz	fixed services, omni antenna
$123 + 10\log(p)$ dB/MHz	mobile operations

Where p is the maximum spectral power density, within the band of operation.

Note: Primosphere has used the resolution bandwidth of 1 MHz, as proposed by the Commission. However an additional requirement is proposed that the out-of-band emission should not exceed 24 dB higher than the above numbers if measured in any 4 kHz slot in the band 2320 to 2345 MHz.

These tightened out-of-band emissions standards are feasible and can be met through the use of filters in the WCS transmitters and the establishment of guard bands within the WCS band segments adjacent to the satellite DARS band. These guard bands would only apply to transmitters operating in the WCS band segments adjacent to the satellite DARS band.

The filter and guard band requirements for a WCS transmitter relative to the DARS receiver can be readily accomplished through practical output filtering. It has been assumed that a mobile PCS unit will have a 100 kHz bandwidth and transmit at approximately 1 watt (0 dBW). With these operating characteristics a 10 section Chebyshev transmit filter and a frequency guard band on the order of 100 to 150 kHz are sufficient to reduce out-of-band emissions to the new levels stated above to protect the satellite DARS operations.

CONCLUSIONS

The out-of-band emission levels proposed from FCC Part 22 (47CFR 22.907 para b. (2)) are insufficient to protect satellite DARS from WCS operations. The proposed levels are inappropriate for WCS as they would allow a very high and totally unacceptable level of interference into the satellite DARS mobile receivers.

The above analysis shows that:

1. The out-of-band emission standards contained in the NPRM for the satellite DARS band are insufficient to protect satellite DARS from WCS operations;

A more appropriate standard for out-of-band emission spectral density from WCS operations into the spectrum set aside only for satellite DARS, 2320 to 2345 MHz, may not exceed the following:

92 + 10Log(p) dB/MHZ fixed services, directional antenna
92 + 10Log(p) dB/MHZ fixed services, omni antenna
123 + 10Log(p) dB/MHZ mobile operations

Where p is the maximum spectral power density within the band of operation.

3. The revised out-of-band emission standards are technically feasible and will have minimal impact to mobile WCS equipment designs.

Prepared by:

/s/ Richard Cooperman 12/04/96
Richard Cooperman Date
Kenneth Manning 12/04/96
Kenneth Manning Date
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Proposed revisions to new part 27:

§ 27.53 Emission limits.

(a) The peak power of any emission outside the licensee's bands of operation shall be attenuated below the maximum peak spectral power density (p) within the band of operation by the following amounts:

(a) For fixed operations: By a factor not less than $43 + 10 \log (p)$ dB on all frequencies between 2300 and 2305 MHz and above 2360 MHz; ~~and not less than~~ $70 + 10 \log (p)$ dB on all frequencies below 2300 MHz; and not less than $92 + \log (p)$ dB on all frequencies between 2320-2345 MHz ~~band~~;

(b) For mobile operations: By a factor not less than $43 + 10 \log (p)$ dB on all frequencies between 2300 and 2305 MHz, and above 2360 MHz; not less than $123 + 10 \log (p)$ dB on all frequencies between 2320 and 2345 MHz; and not less than $70 + 10 \log (p)$ dB on all frequencies below 2300 MHz;

(3) For the purposes of this section, radiolocation shall be classified as either a fixed or mobile service, depending upon the application; and

(4) Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency bands of operation a smaller resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed, provided the measured energy is integrated to provide the total energy in a 1 MHz bandwidth.

(b) For WCS satellite DARS operations: The limits set forth in section 25.202(f) of this chapter apply.

(c) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the edges, both upper and lower, of the licensee's bands of operation as the design permits.

(d) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

§ 27.54 Additional Technical Requirements.

(a) Radio transmitting equipment operating in the 2305-2320 MHz and 2345-2360 MHz bands must utilize circular polarization. This polarization must be of the opposite sense of polarization to that utilized by licensed satellite digital audio radio systems. Licensees of satellite digital audio radio systems must notify the Commission of their choice of polarization not later than six months after the date of issuance of satellite digital audio radio licenses in the 2320-2345 MHz bands.

(b) Under all conditions of modulation the maximum peak EIRP from a fixed radiator operating under this section shall not exceed 100 watts.

(c) Under all conditions of modulation the maximum peak EIRP from a mobile radiator operating under this section shall not exceed 0.5 watt.

§ 27.5455 Frequency stability.

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§ 27.5556 Field Strength limits.

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§ 27.5657 Antenna structures; air navigation safety.

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§ 27.5758 International coordination.

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